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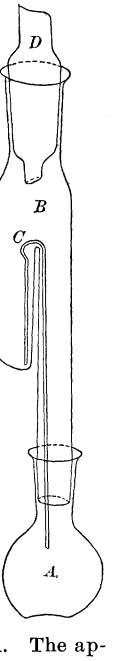
A NEW GLASS SIPHONING EXTRACTION APPARATUS.

J. T. WILLARD AND G. H. FAILYER.

At the meeting of the Academy in 1885 we had the pleasure of describing what still seems to us the simplest percolating extraction apparatus constructed wholly of glass.* We now describe a *siphoning* apparatus which it would seem can hardly be simpler, and which after nearly a year's use we can pronounce entirely satisfactory in its operation.

It may not be out of place to say a few words in justification of the invention of another extractor, notwithstanding the many forms already proposed. In the first place, we are led to reject any extractor which makes cork connections. The extreme difficulty of completely freeing cork from its resinous constituents can only be appreciated by one who has tried it faithfully for a hundred hours or more, placing the properly perforated corks in a large Soxblet extractor and changing the flask occasionally and constantly finding an appreciable extract. The writers have also observed an old, well-used cork suddenly exude a considerable quantity of resin on the upper end of the cork during an extraction. The more perfectly a cork is freed from its resin the less fitted, mechanically, does it become, losing its elasticity and becoming brittle. In the second place, a *siphoning* apparatus must be preferable to a percolating, because we are certain that every particle of the substance is soaked by fresh solvent every time the container is filled, while in a percolating apparatus we can never be quite sure that the solvent is not chiefly flowing down channels of least resistance.

The Soxblet extractor is sometimes made wholly of glass, and in that form will doubtless do good work. Ours, however, has the advantage of greater simplicity, and consequently costs less, as well as being less liable to fracture. By reference to the cut it will be seen that the extractor consists of four parts, viz.: the *flask*, the containing tube, the condensing tube, and the siphon. The flask is small, holding only about 100 cc., and weighing about 20 grams. The containing tube is ground into the neck of the flask, and has a pocket on one side, in which the substance, wrapped in filter paper, is placed for extraction, and into which the short arm of the siphon dips. The condenser tube expands into a stopper for the containing tube, and at the lower end is drawn out and ground off in such a way as to direct the condensed solvent into the pocket containing the substance for analysis. The upper part of the condenser tube passes through a cold-water jacket of some kind; in ours a tank large enough for half a dozen extractors. The siphon is made of small tubing. The internal diameter must not be over one millimeter, and at the bend it is better to have it even less. The capillary attraction of the inner wall of the tube raises the liquid sufficiently to bring the siphon into action before the pocket is full enough to run over. The upper end of the short limb must be bent sharply away from the side of the pocket so as to cut off the capillary action between the outside of the siphon and the side of the pocket against which it touches. If this is not done, the liquid will be drawn over continuously without emptying the pocket, and all the advantages of a siphoning apparatus will be lost. If, however, these details be met in the construction of the siphon, it will act perfectly, and the apparatus will need no attention after the flame under the water bath is adjusted. The ap-



*Transactions Kansas Academy of Science, Vol. X, p. 20; Am. Chem. Journal, Vol. 8, p. 73.

paratus is so constructed that the siphon may be easily removed, and when the extraction is concluded the removal of the siphon and the substance will usually give abundant space to collect the solvent. It is then distilled off from the extract and collected in the pocket. The drying of the extract must be completed in a current of hydrogen, as usual.

This extractor was designed for the quantitative analysis of feeding-stuffs; the side-pocket to contain the substance is therefore made small in our instruments so as to require but little of the absolute ether and to insure quick siphoning. It is, however, apparent that within certain limits the extractor might be made of considerable size.

Our extractors are heated by one water bath; each flask is supported by a spiral spring which has a piece of brass gauze soldered across the upper coil. The spring should be rather stiff, but so adjusted in length as to require but little compression to bring it under the flask.

NOTE.—Mr. J. T. Crawley, in the Am. Chem. Journal, Vol. XI, p. 507, has described an apparatus employing capillary attraction to bring the siphon into action. It is only fair to say that our extractor was designed before the publication of his article.

ANNUAL PRECIPITATION OF RAIN AND SNOW AT MANHATTAN, KANSAS, FOR THE PAST THIRTY-TWO YEARS.

BY C. M. BREESE, MANHATTAN.

The rainfall is often of a local character, so that the measured amount at any one place may hold good for but a limited area. The rainfall at Manhattan, as shown by the accompanying chart, is not claimed to be more than an indication of the precipitation over the rest of the State.

In any agricultural country where the system of irrigation is not practiced, the question of the rainfall and its distribution is one of vital interest—especially that of the distribution. To illustrate: In 1886, 1887 and 1888, the rainfall was about the average, but the crops were poor, being affected by drouth at important periods of growth, and by chinch-bugs. The rainfall of 1889 was a trifle less than that of 1888, and only one inch more than that of 1887, but the crops were excellent. The difference in the distribution of the moisture tells the tale. Again, in 1875 there was a very scanty rainfall, but it was exceedingly well distributed, and I find Riley county is accredited with a wheat crop averaging 14 bushels per acre, corn 41 bushels, oats 28 bushels, and potatoes 90 bushels—pretty good crops for a year when the total precipitation was only 18.16 inches.

"Is the rainfall of Kansas increasing?" Let us examine the record: In the thirty-two years covered there are fourteen above the average, and eighteen below. Dividing the record into two equal periods of time, we find there are in the first half six years above the average, and ten below, while in the second half there are eight above and eight below. The total precipitation for the first half, or previous to 1874, was 468.15 inches, or an annual average of 29.26 inches, while subsequent to and including 1874 there was a precipitation of 508.02 inches, or an average of 31.75 inches, and a difference in favor of the latter period of 2.5 inches per annum. But let us suppose that, instead of extending over thirty-two years, our record had commenced in 1870, and included but twenty years, and we now divide into two equal parts: The total precipitation for the first half is 311.45 inches; for the second, 309.27